



S.S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

April 11, 2018

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105
Attention: Mr. Bob Pallarino

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
Honolulu, HI 96801-3378
Attention: Fenix Grange, M.S., Program Manager

Subject: Comments on Database Files Provided by the Navy

Dear Mr. Pallarino and Ms. Grange:

At the request of the U.S. Environmental Protection Agency ("EPA") and Hawaii Department of Health ("DOH"), collectively the "Regulatory Agencies", I am providing comments and suggestions regarding the database files that were provided by the Navy on and around the time of the Red Hill Groundwater Modeling Working Group (GWMWG) Meeting #8, March 16th, 2018.

First, it is important to clarify for all parties the intents of the requests that the Regulatory Agencies have made of the Navy for a comprehensive database to be made available. The primary intent is that the Regulatory Agencies and their consultants have in their possession, well in advance of receiving project deliverables – such as the interim groundwater flow (capture) model – such data as are necessary and appropriate to complete an efficient, timely and informed technical review of those deliverables. Related intents include the ability for the Regulatory Agencies and their consultants to conduct independent review and quality assurance (QA) of the data supporting the Navy's work; and the ability to determine the completeness and sufficiency of the data in their entirety to support the various decisions pending at the Red Hill Bulk Storage Facility (Red Hill).

This letter summarizes our review and understanding of the contents of the files provided by the Navy at the March 16th GWMWG meeting, and provides recommendations for a more complete, comprehensive database deliverable. General and specific areas of concern are noted below, together with suggestions to remedy these concerns. This letter was developed with contributions

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and correspondence from G.D. Beckett (AQUI-VER, Inc.); Donald Thomas (University of Hawaii); and Robert Whittier (DOH).

Received Database – General Comments

The data provided by the Navy contains a significant amount of data and information, and the Regulatory Agencies appreciate the significant effort to compile these materials. However, the great majority of the data provided is not presented in a uniform “working” digital format suitable for manipulation, extraction and evaluation - such as completing common tasks where all data from a specific date range and all well/sampling locations within that range can be readily retrieved. By way of example: if the Regulatory Agencies desired to plot groundwater elevation data for all available monitored locations during the 3rd quarter of 2015, this could not be accomplished with the data provided – however, the Regulatory Agencies are aware that these data do exist because they have been presented by the Navy and its consultants. Further explanation follows below.

The 3 DVDs that comprise “the database” provided by the Navy contains 3 main folders, some containing subfolders. Within these folders are approximately 4493 files which include 1418 PDF files, 289 text (TXT extension) files, 112 EXCEL files, numerous comma-separated value (CSV extension) files, a large number of geographic information system (i.e., GIS files) including contents of a geodatabase, and a single Microsoft Access database (extension “ACCDB”).

The access database contains five tables, one of which contains information (“metadata”) regarding the database format, and four of which contain data. These four data tables contain water quality sampling results and water level measurement results. The data tables are all text fields (i.e., do not appear to contain numeric fields suitable for quantitative data analysis). The database does not contain a single comprehensive well construction, completion or location table to which all sampling/gauging data can be linked. The database does not appear to contain external links to other files or data sources. The database does not appear to contain any queries for retrieving data in usable formats.

The EXCEL and TXT files collectively appear to contain groundwater level data or hyperlinks to groundwater level data housed on the internet; pumping rate/flow data, and other information that is not contained within the single Microsoft Access database. The data contained in these EXCEL and TXT files do not appear to be consolidated and available within a unified synoptic format from which date and location data can be queried and analyses such as that used as an example above can be undertaken.

The geodatabase contains a collection of feature classes, many of which represent publicly-available information which, while very valuable to the project and pending evaluation of Navy deliverables, was in large part previously obtained independently by the Regulatory Agencies and its consultants. The contents of the geodatabase fall under the following categories:

- Digital Elevation Models (DEMs): three different DEMs of Oahu are included in the geodatabase. Resolution varies between the DEMs from 1 m to 230 m per pixel.

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- Aerial Photography: Two georeferenced aerial images published by the USGS from 4/5/1952 and 1/5/1978.
- Geological data: six polyline or polygon features that are digitized elements of a geologic map. Geologic data includes surficial geology, traces of dikes and faults, sediment thickness contours, ash contact traces, and contours of the “top of volcanics.”
- Hydrology data: seven polyline or polygon features that delimit aquifer extents, streams, Red Hill groundwater model extent, and the USGS estimates for average and drought condition recharge by spatial location.
- Parcel data (polygons of parcels).

The PDF files include stratigraphic logs and well construction logs, in addition to published reports and other documents. The contents of these PDFs are potentially very useful; however, while they have been listed in a reference index, they do not appear to possess either an index key or an established naming convention. As a consequence, if there is a reference identified in the index that a reviewer wishes to access, it is difficult to locate the corresponding PDF.

Database Content and Design Suggestions

The following describes what was anticipated to be included in the project database when the request was made of the Navy by the Regulatory Agencies, and what would be most helpful moving forward to the Regulatory Agencies and its consultants to facilitate review and assessment of future Navy deliverables:

1. A comprehensive database in Microsoft Access or another common format, together with database documentation including:
 - a. Either a database model, data structure diagram or relational diagram explaining the relationships between common fields in the database tables
 - b. A description of the contents of the fields of each of the database tables
2. Major data tables including the following:
 - a. A master location data table, including geographic information for the location and elevations of all samples / other data included in the database and inclusive of recent survey updates
 - b. A master well construction table, including details of the “as-built” construction of all wells possessing data in the database, including measuring point elevations used for water level measurements throughout time
 - c. A drilling activity / data table, including information regarding past and current / recent drilling activities, including soil boring logs
 - d. A data table containing borehole lithology data (interpretation of stratigraphic “pics”, for example)
 - e. One or more data tables containing static (e.g., manual) groundwater level data, typically reporting liquid levels where LNAPL is present

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- f. One or more data tables containing continuous (e.g., datalogger) groundwater level data, typically reporting liquid levels where LNAPL is present
 - g. One or more soil gas data tables, containing soil gas survey data
 - i. Multiple tables are sometimes needed for differing analyte suites, but where possible, a unified data table is preferred (global comment)
 - h. One or more tables containing groundwater sample test results, including biodegradation parameters and isotopic analyses
 - i. One or more tables containing soil / matrix analytic sample test results
 - j. One or more tables containing sample test result QC such as obtained from (a) the testing laboratory or (b) the data validation process
 - k. One or more tables relating individual samples to the batch identifier
 - l. One or more tables containing pumping / flow rate data from wells and shafts
 - m. One or more tables containing hydraulic conductivity profiling data and results
 - n. One or more tables containing petrophysical core sampling results
 - o. One or more tables quantifying the geologic/lithologic materials at all available locations; alternatively, if the quantitative geologic model is in an alternate format, that can be provided
3. Major queries used by the Navy and its consultants to prepare inputs to, and evaluate outputs from, the groundwater and LNAPL models including the following:
- a. Queries used to select data for use in preparation of synoptic water level maps
 - b. Queries used to select data for use in preparation of time-series chemical and water level time-series graphs

With regard to materials provided in PDF format, which is appropriate for certain types of documents and materials: appropriate indexing using either Adobe's built-in indexing capabilities, HTML, or another mechanism, would resolve the difficulty of quickly accessing materials that have been cited and are of interest to reviewers.

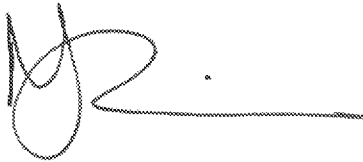
In summary, while the materials provided by the Navy and its consultants is useful, and it is recognized that development of a comprehensive relational database can be a substantial undertaking, the materials provided to-date by the Navy are incomplete and are not in a form that can facilitate independent data analysis and support informed and efficient review of pending Navy deliverables.

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Please feel free to contact me if you have any questions regarding the foregoing concerns.

Sincerely,

S. S. PAPADOPULOS & ASSOCIATES, INC.

A handwritten signature in black ink, appearing to read 'MT', followed by a horizontal line.

Matthew J. Tonkin
President

Example Database Guidelines

Many example database guidelines and proposed structures exist. Below are a couple of useful sites and resources related to environmental database structures:

1. U.S. EPA Region 5 EDD Comprehensive Specification Manual (Version 4.1):

Available at: https://www.epa.gov/sites/production/files/2016-08/documents/r5comprehensivemanual_aug2016.pdf

2. EQUIS Database system:

Information available at: <http://help.earthsoft.com/default.asp?W1644>

3. A useful resource and publication regarding data types:

Available at: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007WR006392>